Laser Materials Processing: Fundamentals and Applications

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Overview

The overarching goal of this course is to disseminate cutting-edge technology and research in the field of laser materials processing. In today's world, lasers offer new and innovative solutions in many areas of manufacturing. Laser materials processing techniques include surface treatment, alloying, cladding, deposition, cutting, drilling, marking, machining and welding. With an introduction to physics of lasers and various types of lasers, fundamentals of laser-material interactions and their implications in various laser materials processing techniques along with innovative applications of laser material processes in manufacturing will be discussed in this course. In line with the current Government of India initiatives on ***MAKE IN INDIA AND SKILL INDIA,*** manufacturing industry personnel and researchers working in this area will immensely benefit from the expertise shared by the speaker on Laser Processing of Materials.

Objectives

The primary objectives of the course are as follows:

- Introduce the participants to fundamental properties of laser beams as advanced materials processing and manufacturing tool.
- Provide the participants an overview of principles involved in laser-material interactions.
- Build broad understanding of laser based physical processes and their implications in material processing and manufacturing processes.
- Provide exposure to practical problems and their solutions through laser based manufacturing processes in various industries.
- Enable the participants to identify, select, and optimize laser materials processes through case studies of practical problems and probable solutions for innovative and potential next generation manufacturing processes.

Teaching Faculty with allotment of Lectures and Tutorials

1. Professor Narendra B. Dahotre (NBD): 6 hrs lectures and 6 hrs tutorials
2. Professor J. Ramkumar (JRK): 4 hrs lectures and 4 hrs tutorials

Course participants will learn these topics through lectures and tutorials. Also case studies and assignments will be shared to stimulate research motivation of participants.

Day 1	Day 2	Day 3	Day 4	Day 5
Lecture 1: Basics of Lasers – Laser Operation Mechanism, Properties of Laser Radiation (NBD : 1hr)	Lecture 3: Laser Materials Interactions: Absorption of Laser Radiation, Thermal Effects (NBD : 1hr)	Lecture 5 : Laser Welding, Laser Marking (JRK : 1hr)	Lecture 7: Laser Surface Alloying, Laser Cladding (NBD : 1hr)	Lecture 9 and Lecture 10: Innovative Applications of Laser Materials Processes in Manufacturing (NBD & JRK : 1hr+ 1hr)
Lecture 2: Basics of Lasers – Types of Industrial Lasers (JRK : 1hr)	Lecture 4: Lasers in Manufacturing: Laser Casting, Laser Forming/Shaping, Laser Joining (NBD : 1 hr)	Lecture 6 : Laser Cutting, Laser Drilling, Machining (NBD & JRK : 1hr+ 1hr)	Lecture 8: Laser Additive Manufacturing - Classification and Processing Philosophy (NBD : 1hr)	
Tutorial: Problem/Questions solving/answering session with examples: Laser Radiation and Laser Operation (NBD : 2 hr)	Tutorial: Problem/Questions solving/answering session with examples: Thermal Effects associated with Physical Processes during Laser Material Interaction (NBD : 2hr)	Tutorial: Problem/Questions solving/answering session with examples: Thermal Effects specific to Industrial Processes (NBD & JRK : 1hr+ 1hr)	Tutorial: Problem/Questions solving/answering session with examples: Compositional and Microstructural Effects during Surface Modification (JRK : 2 hr)	Tutorial: Problem/Questions solving/answering session with examples: Design and optimize laser based manufacturing process for potential application (JRK : 2 hr)

Modules	**Laser Materials Processing: Fundamentals and Applications : 4th to 8th Dec,17**
You Should Attend If…	▪ Executives, engineers and researchers from manufacturing, service and government organizations including R&D laboratories and industry. ▪ Students at all levels (BTech/MSc/MTech/PhD) or Faculty from academic institutions and technical institutions
Fees	The participation fees for taking the course is as follows: **Participants from abroad : US $500** **Industry/ Research Organizations: ` 30000** **Academic Institutions: ` 10000** The above fee include all instructional materials, computer use for tutorials and assignments, laboratory equipment usage charges, 24 hr free internet facility. The participants will be provided with accommodation on payment basis.

The Faculty

Professor Narendra B. Dahotre is a University Distinguished Research Professor and former Chairman (2010-2013) of the Department of Materials Science and Engineering, University of North Texas (UNT), USA. He is founding Director of Center for Advanced Orthopedics at University of North Texas with international academic/industrial members collaborating on R&D and implementation of science/technology. Prior to joining UNT he had held a joint faculty appointment with Oak Ridge National Laboratory and Department of Materials Science and Engineering of the University of Tennessee-Knoxville (2002-2010). Moreover, he was Director, Deputy Director, and a senior faculty member of the Center of Research Excellence for Laser Applications at the University of Tennessee (1995-2010). He has been recognized for the pioneering contributions to fundamental understanding and engineering of laser materials interactions along with implementation of high power lasers in materials and processing and advanced manufacturing with primary emphasis on surface engineering, additive manufacturing, and machining. In this regard, he is internationally known for his work on fundamentals and applications of laser surface engineering of metals, ceramics, composites, and biomaterials and laser machining of ceramics**.** So far his work in the area of laser processing/manufacturing of biomaterials has resulted in over 35 publications, authorship of one book (Machining of Bones and Hard Tissues Springer International Publishing, AG Switzerland, 2016) and one issued US patent (Laser Assisted Machining (LAM) of Hard Tissues and Bones, US Patent #9,387,041, 2016) and two pending US patents. His work over 25 years on laser materials-interactions has been compiled in 4 books as author and 13 books as editor in areas of laser materials processing/manufacturing and surface engineering, 16 issued and 2 pending U.S. Patents, and 267 publications. He is a founding Editor-in-Chief of International Journal of Additive and Subtractive Materials Manufacturing, Editor of Optics and Laser Technology, and currently serving on 8 editorial boards of refereed journals in the area of materials science and engineering.

Course Co-ordinator

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